REMARKS

The Applicants' specification notes the problem of organic molecules adhering to a cleaned surface (spanning pages 1-2). These contaminants are, naturally, of various chemical types. Straight-chain organic compounds that are absorbed onto a surface can be removed by heating, but other types of molecules will not be removed by heating, which is the reason why prior artisans kept cleaned wafers in elaborate, expensive mini-environments (page 2, line 4). If the heat of subsequent processes reliably removed all the contaminants, of course there would be no problem. The Applicants explain (page 9, line 4):

> (1) By employing high molecules, the coating condition can be safely maintained. The reason for this is that, in adsorption of organic substances, organic substances of low molecular weight are the first to be adsorbed, so by substituting these with high molecules, a superior coating condition can be produced. In contrast, if the surface is initially coated with a high molecular organic substance, the probability of substitution by other substances is abruptly reduced, so a superior coating condition cannot be achieved.
>
> (2) When performing wafer treatment such as etching or CVD film formation, the aforesaid high molecular organic substance is required to be easily releasable, without being left behind as a residue on the wafer. Broadly, there are three types of high molecular organic substances, namely, straight-chain organic compounds, cyclic compounds (without double bonds) or cyclic double-bond compounds. Of these, straight-chain organic compounds satisfy the above object and can be sufficiently removed with the temperatures and atmospheres employed in semiconductor manufacture. For this reason, this type was selected.

(3) Also, supplementary to (2) above, by selecting a substance of lower boiling point than the heat treatment temperature of the wafer processing of the next step, this substance can be removed prior to actual heat treatment by the heat treatment of the next step.

Amended claims 1 and 7 recite features related to this concept, and their subject matter provides the following advantageous effects.

(1) The clean surface condition of semiconductor substrate can be maintained without the large investment and cumbersome operation of a mini-environment.

(2) The high molecular straight-chain organic compound is removed by the processing temperature of the subsequent step, so no additional heating step is needed.

(3) The clean surface is maintained right up until the wafer is already in the next processing machine, away from the ambient air, so the clean surface is maintained without any chance of contamination.

Claims 1-3 and 6 were rejected under 35 USC §102 over Garito '315. This rejection is respectfully traversed on the basis that Garito does not disclose the steps now recited in amended claim 1 (and also claim 7).

The applied text at col. 22, lines 10-47, discloses dissolving a coating with acetone (Example 22) and also coating a surface with silane (Example 23). The Examiner asserts that evaporation of an organic compound is disclosed at col. 22, lines 60-63, but the Applicants respectfully disagree. These lines describe Garito's Example 25, which is completely separate from the Examples 22 and 23 which are relied upon for disclosing a coating. Example 25 explicitly refers to the "the amide of Example 14," and mentions no other compound. Also, Example 25 discloses "50°-60° C" *without* removal of the coating.

None of the text applied in the rejection mentions "clean" or "cleaning," "boiling point," or "temperature of heat treatment," the features recited in the instant claims. Garito is not concerned with cleaning, only with photoresist patterning, and discloses no cleaning methods.

Claims 7, 9, and 12 were rejected under 35 USC §102 over Egami '733. This rejection is respectfully traversed.

(1) Egami is concerned with removing an edge "bump" after spin coating. The applied text in cols. 5-6 describes an apparatus (Fig. 2) with nozzles including a nozzle 4 for washing the underside of a substrate and a nozzle 3 for washing the periphery of the upper side. A third nozzle 2 is for coating the upper side as it spins.

The nozzle 3 is aimed at the periphery and there is no disclosure of it cleaning the central area. Even if aimed that way, there would be no cleaning because the substrate spins and the centrifugal force would throw the cleaning solution away from the central region. Egami itself discloses that the purpose of the nozzle 3 is to remove a projected portion of the coating *after* the coating is applied (col. 6, lines 25-35).

Thus, there is no disclosure of the Applicants' feature of "washing a semiconductor substrate so as to make the surface clean; and depositing a high molecular straight-chain organic compound ... onto the clean surface."

(2) Egami's process is for making an inter layer dielectric film 34 that is sandwiched between two other insulating films 32 and 35 (Fig. 9) and is intended to planarize (col. 1, line 58; col. 4, line 66). This layer is preferably formed by spin coating, but the usual method leaves a rim or "bump" shown in Fig. 10 (col. 2). Thus, the subsequent step is forming the layer 35 or 12" (Figs. 9 and 5, respectively). However, there is no disclosure concerning these layers or their formation. In particular, there is no disclosure of what temperatures are involved in forming them.

(3) With respect, the text cited by the Examiner at col. 10, lines 51-56 is not seen to refer to any subsequent step (i.e., forming the layer 35 or 12") but rather to the step of forming the inter layer dielectric film itself. The resin mentioned there is seen to be a carrier for the insulating substances, which are left behind after evaporation of the resin.

(4) The Examiner has not pointed out any specific example of a high molecular straight-chain organic compound that is disclosed by Egami.

Claims 4-5 were rejected under 35 USC §103 over Garito. This rejection is respectfully traversed.

The Examiner asserts that selecting the claimed compounds would have been obvious "to achieve its [Garito's] objective," but the Applicants disagree. The objective of Garito is a better photoresist, not a cleaner surface. It is not clear how the claimed compounds, which were chosen by the Applicants to keep a surface clean, would make a better photoresist.

Claims 10-11were rejected under 35 USC §103 over Egami. This rejection is respectfully traversed.

The Examiner asserts that selecting the claimed compounds would have been obvious to achieve Egami's objective. But, with respect, there again is no motivation for choosing these substances. Egami wants to make an insulating layer and is not at all concerned with cleaning the surface—as noted above, the coated upper surface is not cleaned, only the bottom and the periphery. There is no showing that the claimed compounds would be useful for an insulating layer, or would be an improvement over the insulating substances taught by Egami.

Claim 8 was rejected under 35 USC §103 over Egami in view of Sato '867. This rejection is respectfully traversed.

Sato does not actually disclose any boiling temperature in the cited text; it only says the boiling point is "high." The Examiner relies on Sato for this feature, stating that Egami does not disclose it. Therefore, neither reference discloses 500 °C.

With respect, there is no support for the assertion that manufacture would be facilitated and device speed increased if Egami were to use Sato's siloxane polymer, instead of one of the many compounds Egami discloses. The Examiner presents neither citation nor reasoned argument in support of this assertion.

The new claims are patentable for the reasons above. Also, the prior art does not disclose the processes, ratio of molecular weights, or clean room recited in the new claims.

Respectfully submitted,

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Date

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